HR-192 Evaluation of Dense Bridge Floor Concrete Using High Range Water Reducer

Key Words: Water reducer, HRWR, Portland cement concrete (PCC), Dense bridge floors

ABSTRACT

Much effort is being expended by various state, federal, and private organizations to protect and preserve concrete bridge floors. The generally recognized culprit is the chloride ion from the deicing salt reaching the reinforcing steel, and along with water and oxygen, causing corrosion. The corrosion process exerts pressure which eventually causes cracks and spalls in the bridge floor. To prevent corrosion, the reinforcing steel has been coated; various types of "waterproof" membranes have been placed on the deck surface; decks have been surfaced with dense and modified concrete; decks have been electrically protected; and attempts to internally seal the concrete have been made. No one method has been proven and accepted by the various government agencies as being the "best" when considering the initial cost, application effort, length and effectiveness of protection.

This research is an effort to prevent bridge deck deterioration by using a high range water reducing admixture (HRWR) to obtain a dense concrete that is workable during construction to prevent chloride intrusion.

The objectives of this research project were:

(1) To determine the feasibility of proportioning, mixing, placing and finishing a dense Portland cement concrete in a bridge floor using conventional mixing, placing and finishing equipment.
(2) To determine the economics, longevity, maintenance performance and protective qualities of a dense Portland cement concrete bridge floor when using a high range water reducing admixture.

The purpose of a high range water reducing admixture is to produce a dense, high quality concrete at a low water-cement ratio with adequate workability. A low water-cement ratio contributes greatly to increased strength. The normal 7-day strength of untreated concrete would be expected in 3 days using a superplasticizer. A dense concrete also has the desirable properties of excellent durability and reduced permeability.

It is felt that a higher quality, denser, higher strength Portland cement concrete can be produced and placed, using conventional equipment, by the addition of a high range water reducing admixture. Such a dense concrete, with a water/cement ratio of approximately 0.3 to 0.35, would be expected to be much less permeable and thus retard the intrusion of chloride. With care and attention given to obtaining the design cover over steel (2 ½ inches clear), it is hoped that protection for the design life of the structure will be obtained.